



DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION SPECIFICATION

MOBILE AIRPORT SURVEILLANCE RADAR (MASR) SYSTEM

1. SCOPE

1.1 Scope.- The equipment specified herein is a Mobile Airport Surveillance Radar (MASR) System. The MASR, when deployed and activated, will achieve the following operational goals:

Temporary Service

- (a) While an existing ASR Transmitter Site in the FAA inventory is undergoing modernization, refurbishment, etc.
- (b) At a proposed location for a permanent ASR Transmitter Site, for evaluation of expected terminal airspace coverage.
- (c) At a location not radar-equipped.

Emergency Service

- (a) During or following a natural disaster at an existing ASR Transmitter Site.
- (b) Due to catastrophic failure of an existing ASR Transmitter Site.

The MASR will utilize Government-furnished ASR-8/ATCBI-5/MX-8757 electronics economically packaged by the contractor within a single eight foot wide, forty foot long, all weather shelter. This shelter will be integral with a standard-type highway semitrailer. Expeditious transport will be possible without need for special devices or official permits, over all federal and state highways and roads.

The MASR antennas/tower subsystem will be eminently mobile, self-erectable and stable when active. Erection of this subsystem will be an uncomplicated process quickly accomplished by not more than four ASR Transmitter Site FAA journeymen electronics technicians.

AC power for the MASR will be supplied from its ancillary engine generator set or commercial power when available.

Remote control of relevant MASR functions will be from a single designated point at an FAA Indicator Site and will be accomplished by digital, MPX/DMPX, or similar means.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA specifications and standards, of the issues in effect on the date of issuance of the invitation for bids or requests for proposals, form a part of this specification and are applicable to the extent specified herein.

2.1.1 FAA specifications.-

FAA-C-1217c	Electrical Work, Interior
FAA-C-2256a	Temperature and Humidity Control Equipment
FAA-C-2507	ASR Transmitter Receiver Building
FAA-D-2494	Instruction Book Manuscripts, Technical
FAA-E-2204a	Engine Generator Sets, 5KW to 300KW
FAA-E-2236a	Housing, Power Plant, Van Mounted
FAA-E-2318	Antenna, ATCRBS, Directional (FA-8043)
FAA-E-2319b	Air Traffic Control Beacon Interrogator (ATCBI)
FAA-E-2502	Air Traffic Control Radar Beacon System (ATCRBS) Test Set
FAA-E-2506	Airport Surveillance Radar (ASR) Transmitter/Receiver (T/R) Subsystem
FAA-G-1210c	Provisioning Technical Documents
FAA-G-2100	Electronic Equipment, General Requirements
FAA-R-1401b	Antenna, ATCRBS, SLS Omni-Directional (FA-8044)

2.1.2 FAA standards.-

FAA-STD-001a	Color and Texture of Finishes for National Airspace System Equipment
FAA-STD-003	Paint Systems for Structures
FAA-STD-004a	Criteria for Selection and Installation of Fire Extinguishers
FAA-STD-010b	Graphic Symbols for Digital Logic Diagrams
FAA-STD-012a	Paint Systems for Equipment
FAA-STD-013a	Quality Control Program Requirements

2.2 Military publications.- The following Military publications, of the issues in effect on the date of issuance of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.2.1 Military specifications.-

DOD AIMS 65-618A	Defruiter Set, MX-8757
MIL-M-8090F	Mobility, Towed Aerospace Ground Equipment, General Requirements for
MIL-H-46855A	Human Engineering Requirements for Military Systems, Equipment and Facilities

2.2.2 Military standards.-

MIL-STD-1472A	Human Engineering Design Criteria for Military Systems Equipment and Facilities
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2.3 Other publications.- The following publications, of the issue in effect on the date of issuance of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein:

NFPA No. 70-1975	National Electrical Code 1975
NFPA No. 78	Lightning Protection Code
FAA Order 1320.38	Equipment Instruction Book Manuscript Replacement Pages
FAA Order 3400.3D	Airway Facilities Maintenance Personnel Certification Program

FAA Order
6000.15

Maintenance of Airway Facilities

FAA Order
6030.22A

Certification of Systems, Subsystems, and Equipment

FAA Order
6310.3

ASR-8/ATCBI-5 Implementation

(Copies of this specification and other FAA specifications, standards, and drawings may be obtained from the Contracting Officer in the Federal Aviation Administration office issuing the invitation for bids or request for proposals. Request should fully identify material described, i.e., specification, standard, amendment, and drawings, numbers and dates. Request should cite the invitation for bids, request for proposals, or the contract involved, or other use to be made of the requested material.)

(FAA Orders are available for inspection at the FAA Library, FOB-10A, 800 Independence Avenue, S. W., Washington, D. C.)

(Copies of the National Electrical Code and Lightning Protection Code may be requested from the National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210)

(Single copies of Military specifications and standards may be obtained from the Federal Aviation Administration, Washington, D. C. 20591, ATTN: Contracting Officer. Requests should cite the invitation for bids, request for proposals, or contract for which the material is needed. Mail requests, if found acceptable, will be forwarded to a Military supply depot for filling; hence, ample time should be allowed.)

3. REQUIREMENTS

3.1 Materials to be furnished by the contractor.- The contractor will be furnished ASR/SECRA electronics and engine generator equipment (3.3) to integrate into the MASR system. The contractor shall design, build, fabricate, package, or otherwise provide all additional hardware/materials needed to achieve the MASR performance parameters specified herein. The following listing is the minimum material to be furnished by the contractor:

(a) ASR hardware/modifications:

- (1) Tuneable RX/TX from 2700 MHz to 2900 MHz.
- (2) Selsyn (synchro) equipment, antenna mounted.
- (3) A/D converter, D/A converter.
- (4) Staggered and unstaggered SECRA pretriggers.
- (5) Local/remote control.

- (b) Shelters:
 - (1) Electronics.
 - (2) Environmental support subsystem.
- (c) Site interface kit(s).
- (d) Cable-RF, signal, AC, etc.
- (e) Trailer unit(s), highway semitype.
- (f) Mobile antenna/tower subsystem.
- (g) Remote control.
- (h) Environmental support subsystem - heating, ventilating, and air conditioning (HVAC).

3.2 Services to be furnished by the contractor.- The contractor shall perform services according to the following summary:

- (a) Design, construct and test the enclosure(s), shelters, and trailer(s) specified herein.
- (b) Modify the ASR-8 (GFE) as specified herein.
- (c) Install and test the modified ASR-8 and SECRA (GFE) electronics into the shelter.
- (d) Install and test GFE test equipment into the shelter.
- (e) Colligate and test GFE engine generator set and HVAC with electronics shelter/trailer.
- (f) Design, construct, and test site interface kit(s) specified herein.
- (g) Design, construct, and test the mobile, erectable tower/antenna subsystem.
- (h) Perform dynamic system operational readiness demonstration specified herein.

3.3 Equipment to be furnished by the Government.- The Government shall furnish ASR and SECRA electronics and a diesel-powered engine generator set to the contractor. This Government-furnished equipment (GFE) shall consist of the following items which shall be delivered by the Government to the contractor at the time and place specified in the invitation for bids or other solicitation:

- (a) Airport Surveillance Radar (ASR) Transmitter/Receiver (T/R) subsystem per FAA Specification FAA-E-2506. This is an ASR-8 without transportable building.

- (b) Air Traffic Control Beacon Interrogator (ATCBI), per FAA Specification FAA-E-2319b. This is an ATCBI-5.
- (c) Air Traffic Control Radar Beacon System (ATCRBS) Test Set per FAA Specification FAA-E-2502.
- (d) Antenna, ATCRBS, Directional, per FAA Specification FAA-E-2318.
- (e) Antenna, ATCRBS, Omni-Directional, per FAA Specification FAA-R-1401b.
- (f) Digital Defruiter set, per USN Specification DOD AIMS 65-618A.
- (g) Engine generator set, per FAA Specification FAA-E-2204a.
- (h) Test Equipment, as follows:

<u>MFGR</u>	<u>MODEL</u>	<u>DESCRIPTION</u>
HP	AN/USM 281c(e)	Oscilloscope
HP	100109	Dolly
HP	1110A	Current Probe
	TS 270B U/P	Echo Box
HP	2001B	Sweep/Signal Generator
HP	8616 A (8732B)	S-Band Test Set
HP	8403 A E25-8616A	Signal Generator
HP	432A	Modulator
HP	478A	Power Meter
HP		Thermistor Mount
Data Pulse	110B	Pulse Generator
HP	536A	Wavemeter
AIL	Model 75	Noise Figure Test Set
AIL	SND 230242	Signal to Noise Detector
Biddle	21159	Test Set, Insulation
Triplett	801	Meter (VOM)
Fluke	8000A	Digital Voltmeter (DVM)

Systron Donner	762-1	Spectrum Analyzer
HP	420A	Crystal Detector
HP	8472A	Crystal Detector
HP	R532A	Frequency Meter
HP	R486A	Thermistor Mount

3.4 Definitions.-

3.4.1 MASR.- Mobile Airport Surveillance Radar.

3.4.1.1 ASR subsystem.- The contractor-modified ASR-8 used in the MASR system.

3.4.1.2 SECRA subsystem.- Contractor-installed ATCBI-5/MX-8757 MASR equipment.

3.4.1.3 Tower/antenna subsystem.- Mobile tower unit with ASR/SECRA antennas.

3.4.1.4 Environmental support subsystem.- Engine generator, heating, ventilation and air-conditioning equipment.

3.4.2 ASR.- Airport Surveillance Radar, types ASR-3/4/5/6/7/8.

3.4.2.1 ASR-8.- Equipment produced to FAA Specification FAA-E-2506.

3.4.2.2 ASR transmitter site.- A formally identified geographical location containing ASR, SECRA, engine generator, air conditioning, heating, etc., equipments. Frequently referred to as the terminal radar system. RADAR/SECRA information generated at the ASR Transmitter Site is transmitted by either landlines or RML, or both, to an FAA Indicator Site(s), where the information is visually displayed for use in air traffic control.

3.4.3 SECRA.- Secondary radar consisting of beacon interrogator set (with SLS) and defruiter, colocated with ASR equipment at an ASR Transmitter Site.

3.4.3.1 ATCBI-5.- Beacon interrogator set manufactured to FAA Specification FAA-E-2319b.

3.4.3.2 MX-8757.- Digital defruiter set, per USN Specifications DOD AIMS 65-618A and amendments. Also known as "digital defruiter".

3.4.4 Certification credentials.- FAA's written determination that a specific employee may attest to system, subsystem, or equipment technical performance.

3.4.5 Operational equipment.- FAA equipment meeting certification parameters and providing technical performance required by air traffic control needs.

3.4.6 Periodic maintenance (PM).- Routine scheduled maintenance designed to preserve the equipment and to reduce the chance for failure.

3.4.7 Relevant failure.- Performance less than required by paragraph 3.6, due to failure of contractor-modified or provided equipment.

3.4.8 State and federal highways.- The National System of Interstate and Defense Highways (Interstate Highways, e. g., "I-270") and the U. S. numbered highway system (identified in each state by highway markers consisting of a black and white shield showing the state name and the U. S. route number, e. g., "US 40").

3.5 System description.- The MASR system shall consist of the GFE ASR/SECRA/engine generator equipment, as contractor-modified, packaged, and integrated into an eminently mobile configuration.

The mobility shall be provided by means of not more than two trailers of the type commonly referred to as semitrailers. One trailer shall contain the ASR and SECRA electronics and the emergency power generator. The other trailer shall contain all erectable tower and antenna hardware required to satisfy the mobile ASR concept specified herein. Each trailer comprising the completed MASR system shall be limited in size to a maximum extent and shall not exceed a total volume described by the boundaries 40 feet by 8 feet by 13 feet, 6 inches. Special devices or official government permits shall not be required for MASR highway transport. Trailer units shall be protected against adverse effects of weather and of transport over state and federal highways of the United States of America.

A typical intended use of the MASR system is emergency deployment via commercial leased tractor(s)/operator(s) over state and federal highways from a given FAA ASR Transmitter Site airport location anywhere in the Continental USA (or FAA Depot at Oklahoma City, Oklahoma) to any other ASR Transmitter Site within the Continental USA. After arrival at the location experiencing the emergency, the time required by a maximum of four FAA Electronics Technicians (possessing certification credentials for ASR-8, ATCBI-5 systems, subsystems, and equipment) to completely set up and fully activate the MASR system shall not exceed eight consecutive hours.

3.5.1 Design criteria.- The prime considerations of the overall MASR system design shall be the achievement of the maximum in performance, reliability, and maintainability in an easily transportable package. The system shall be a completely operational equipment within eight consecutive hours after arrival at a site. Transport packaging shall consist of no more than two individual semitrailer-type units (one with electronics/shelters and environmental support subsystem) designed for over-the-road transport, without need for special state/federal highway permits.

The electronics, consisting of ASR and SECRA subsystems, shall be contained in one shelter adjacent to the environmental support subsystem shelter, both integrated into a highway-type semitrailer. The other MASR unit shall contain the tower/antenna subsystem mounted on a separate highway-type semitrailer. Interconnection among component subsystems, equipments, and site interfaces shall be easily accomplished by using waterproof quick disconnects. Electronics packaging within the shelter (cabinets, racks, test equipment, spare parts, etc.) shall be designed by the contractor to be commensurate with the mobile concept identified herein. All MASR equipment shall be protected from damage due to shock, vibration, and other deleterious effects while the MASR is in transit.

3.6 Performance.-

3.6.1 System.- The MASR system shall meet all ASR-8 parameters of FAA Specification FAA-E-2506, unless specifically exempted by this MASR specification. The MASR system shall meet all ATCBI-5, MX-8757, FA-8043, FA-8044 parameters defined by applicable specifications listed in paragraph 2. The MASR shall be towable over all federal and state highways, at normal speeds for commercial tractor-trailers of comparable size and gross weight and shall require no special handling or repair due to transit.

The MASR shall be a completely operational system within eight consecutive hours after arrival at a given FAA ASR Transmitter Site location.

Remote control of relevant MASR ASR/SECRA/Antenna functions shall be from a single designated location at the FAA Indicator Site.

AC power to set up and operate the MASR system shall be provided by an integral diesel-powered engine generator set, or commercial power when available.

The MASR system shall provide performance to the extent of successful substitution, from an air traffic control standpoint, for any existing operational ASR Transmitter Site.

3.6.1.1 Service conditions.- The MASR system, while operating shall sustain the maximum stresses imposed by the following ambient service conditions without permanent deformation, damage, or degradation of operations:

Temperature	-50°C to +70°C (-58°F to +158°F)
Relative Humidity	5% to 100%, including condensation due to temperature changes
Wind Velocity	63 mph (including gusts)
Roof Snow Load	40 psf
Environment	Hail stones - 1/2 inch diameter, salt spray, urban industrial fumes, fungus - as encountered in warm, humid atmosphere, wind borne sand and dust - as encountered in deserts and plains of western United States, rain. Ice loading - encased in 1/2 inch radial thickness clear ice.

3.6.1.2 Service life.- The MASR system shall be designed and constructed to have a nominal service life of at least 20 years under conditions of intermittent operation, long periods of storage and frequent trips over the road.

3.6.1.3 Remote control.- All ASR and SECRA remote control functions shall be remotored to a single point at an FAA Indicator Site. Remoting shall be over existing landlines or microwave link. Devices provided for this purpose shall be completely self-contained with the exception of AC power. Electronics shall be MPX/DMPX or other digital circuitry which will provide control over no more than two pairs of AWG #19 voice quality landlines of 25,000 feet maximum length or a single two-way RML voice channel. Optimum impedance matching for both RML and landline remoting schemes shall be switch selectable. All ASR/SECRA control functions remotored shall be protected from external interference causing false control operation and status readback indication.

3.6.1.3.1 ASR-8.- The MASR ASR remote control function and status readback shall substitute for the remote site point of control function specified in paragraph 3.15.1 of FAA Specification FAA-E-2506. All modifications necessary to ASR-8 hardware to accomplish this requirement shall be performed by the contractor.

3.6.1.3.2 SECRA.- ATCBI-5 and MX-8757 equipment shall be interfaced to provide remote control and status readback of relevant ATCBI-5 (per paragraphs 3.7 through 3.7.5 of FAA Specification FAA-E-2319b) and MX-8757 (per paragraphs 3.2.2.16.3 and 3.2.2.16.3.1 of USN Specification DOD AIMS 65-618A) functions.

3.6.1.3.3 Engine generator.- The engine generator shall have "emergency start" remotored to the FAA Indicator Site. Activation of this control shall result in engine generator online operation and lock-out of commercial power within 15 seconds. The engine generator shall remain online at all times while the "emergency start" function is active. This feature provides remote control of the extended load function described by paragraphs 3.4.9 and 3.4.10 of Specification FAA-E-2204a.

3.6.1.4 Grounding.- The internal and external grounding of the MASR shall be in accordance with Article 250 of the National Electrical Code 1975 and paragraph 3.5.5 of FAA Specification FAA-C-2507.

3.6.1.5 Human engineering design.- The contractor shall apply the principles of human engineering design specified by MIL-H-46855A and MIL-STD-1472A in translating the mobile ASR concept into practical hardware. The contractor shall specifically identify and document the areas, methodology and results of the human engineering design effort in producing the MASR system.

3.6.2 ASR subsystem.- The ASR shall meet the following parameters:

<u>PARAMETER</u>	<u>VALUE</u>	<u>POINT OF MEASUREMENT</u>
Operating Frequency	2700 - 2900 MHz	
VSWR	1.2 : 1	TX Klystron Output
TX Peak Power	1.0 MW	Antenna side of diplexer
TX P. W.	0.6 \pm 0.05 us	Antenna side of diplexer
RX N. F.	4.0 db	Antenna side of circulator

Nml RX MDS	-110 dbm	MASR RCJB
MTI RX MDS	-108 dbm	MASR RCJB
MTI Log RX MDS	-106 dbm	MASR RCJB
MTI RX SCV	-28 db	MASR RCJB
Output signals	per Specification FAA-E-2506, paragraphs 3.15.2.2.1 and 3.14.1.2	MASR RCJB
Synchro output	90 v, L/L	MASR RCJB
A/D converter output	per Specification FAA-E-2506, paragraph 3.15.2.2.1	MASR RCJB
D/A converter output	90 v L/L	MASR RCJB
Output triggers to SECRA	per Specification FAA-E-2506, paragraphs 3.14.1.1, 3.14.1.2 and subparagraphs thereto	Aligned (Destaggered)
	per Specification FAA-E-2506, paragraphs 3.14.1.1, 3.14.1.2 and subparagraphs thereto	Staggered

The contractor shall not degrade any FAA Specification FAA-E-2506 performance parameter of the GFE ASR-8 in meeting requirements for the MASR system.

3.6.2.1 Waveguide.- Sufficient waveguide shall be supplied with the MASR to connect the ASR transmitters to the antenna when the electronics shelter trailer is 50 feet from the fully erected antenna tower. The waveguide run between the electronics shelter trailer and the antenna shall be disconnectable at both ends for transport, storage, and maintenance. Flexible waveguide sections shall be provided to permit easy mechanical alignment of waveguide when the MASR is placed on uneven terrain. Weathertight seals shall be provided to cover the waveguide ends exposed during transport and storage.

3.6.2.2 Radiation hazard.- The contractor shall determine and conspicuously post or otherwise clearly identify on the MASR all areas where microwave radiation of the ASR subsystem is $10\text{mw}/\text{cm}^2$ and greater. A pictorial diagram showing these areas shall be affixed to the exterior side of the electronics shelter entrances and on the antenna/tower subsystem.

3.6.2.3 Azimuth position data.- The GFE ASR-8 azimuth position data system (paragraph 3.8.9 and subparagraphs thereunder of Specification FAA-E-2506) shall be contractor-modified to provide one each selsyn (1X synchro control transmitters) system instead of the second (dual) antenna-mounted APG unit. The APG unit thus excessed shall be provided as MASR spare stock within the electronics shelter. The MASR azimuth position data equipment, therefore, shall consist of a single APG unit providing active ARP/ACP data and a single selsyn unit providing active 1X data. Redundancy for each of these units shall be provided according to the following paragraphs 3.6.2.3.1 and 3.6.2.3.2.

3.6.2.3.1 Digital to analog (D/A) converter.- A solid-state D/A converter shall be provided, installed in the electronics shelter, and connected to the antenna-mounted APG to furnish dual redundancy service for the antenna-mounted selsyn (3.6.2.3.3). When the MASR is deployed to a "synchro only" ASR Transmitter Site, the D/A converter shall provide synchro duality. Activation of the D/A converter for this purpose shall require operation of its on/off switch, only. D/A performance shall equal that of the antenna-mounted selsyn.

3.6.2.3.2 Analog to digital (A/D) converter.- A solid-state A/D converter shall be provided and installed in the electronics shelter to furnish dual redundancy service for the antenna-mounted APG unit. When the MASR is deployed to an "APG only" ASR Transmitter Site, the A/D converter shall provide APG duality. Activation of the A/D converter for this purpose shall require operation of its on/off switch, only. A/D performance shall equal that of the antenna-mounted APG unit.

3.6.2.3.3 Selsyn (synchro) equipment.- The antenna-mounted selsyn shall provide one speed (1X) synchro data required at FAA ASR Transmitter Sites. Changing of mechanical orientation throughout 0 to 360 degrees rotation shall be a simple, easily performed process. The MASR selsyn (synchro) equipment shall be capable of driving a maximum of 10 FAA Indicator Site servo assemblies.

3.6.2.4 Frequency agility.- The contractor shall modify and provision the GFE ASR-8 for MASR operating frequency agility throughout the frequency spectrum 2.7 GHz to 2.9 GHz. Changing of the MASR operating frequency shall be a simple maintenance tuning procedure. The GFE ASR-8 diplexing equipment shall be replaced with tuneable units. Adequate quantities of crystals that establish operating frequency of the ASR-8 shall be provided to permit substitution of the MASR system for any FAA Transmitter Site, provided that at least 50 crystals are furnished to give operating frequencies at 4 MHz through the range 2.7 GHz to 2.9 GHz.

3.6.3 SECRA subsystem.- The SECRA shall meet or exceed the following parameters:

<u>PARAMETER</u>	<u>VALUE</u>	<u>POINT OF MEASUREMENT</u>
TX Frequency	1030 \pm 0.2 MHz	per instruction book
RX Frequency	1090 \pm 0.2 MHz	per instruction book
TX Power	\approx 35 dBW	per instruction book
RX Sensitivity	-87 dbm	per instruction book
RX N. F.	9 db	per instruction book
Output signals Defruiter "ON"	per USN Specification DOD AIMS 65-618A, paragraph 3.2.2.13.2.2.1	MASR RCJB
Output signals Defruiter "OFF"	per FAA Specification FAA-E-2319b, paragraph 3.4.6 and subparagraphs thereunder	MASR RCJB

The contractor shall not degrade any performance parameter of Specifications DOD AIMS 65-618A and FAA-E-2319b of the GFE SECRA in meeting the requirements of this MASR specification.

3.6.3.1 Coaxial cable.- Sufficient cable shall be supplied with the MASR to connect the SECRA transmitter to the directional and omni-antennas when the electronics shelter trailer is 50 feet from the fully erected antenna tower. The coaxial cable runs shall be disconnectable at the ends for transport, storage, and maintenance. Weathertight seals shall be provided to cover all cable ends exposed during transport and storage. Semirigid and rigid coaxial cable shall not be used.

3.6.4 Antenna/tower subsystem.- This subsystem shall be designed to be operated by FAA electronics technicians with no previous training or experience other than that required for ATCBI-5/MX-8757 and ASR-8 certification credentials. The process involved in achieving operational equipment from the initial arrival state of this subsystem shall be simple, uncomplicated, safe, and require minimal physical effort. All tools and special devices required to completely activate the antenna/tower subsystem shall be provided and packaged with the subsystem. Site preparation shall not be required.

3.6.4.1 Tower assembly.- Tower height, when fully erected (measured from ground level to the topmost point on the platform upon which the ASR-8 antenna pedestal is mounted), shall be 17 feet. Tower leveling shall be easily performed. Erection of the tower shall be a matter of electronics technicians control of electrical/hydraulic devices. Guying shall not be required to sustain operation for winds, including gusts, of less than 63 mph. Installation of the ASR/SECRA antenna assemblies upon the tower shall also be a function of electrical/hydraulic devices controlled by electronics technicians. Tower design shall be submitted to the FAA for approval prior to fabrication or assembly.

3.6.4.2 ASR antenna assembly.- The GFE ASR-8 antenna assembly shall be contractor-modified for mobile use. Any technique used to achieve this requirement is acceptable provided that the mechanical and electrical antenna parameters of Specification FAA-E-2506 are not degraded. These parameters shall be demonstrated true mechanically by measurement of mechanical limits and electrically by satisfactory completion of the FAA flight inspection required by paragraph 4.2.4 of this MASR specification.

3.6.4.3 SECRA antennas.- The GFE SECRA antennas (FA-8043, FA-8044) installation shall be a simple process easily accomplished by FAA electronics technicians. Installed antennas shall be in full compliance with paragraphs 3.8.7.4 through 3.8.7.4.2.1 of Specification FAA-E-2506.

3.6.5 Environmental support subsystem (ESS).- This subsystem shall consist of the GFE engine generator set in concert with contractor-designed and provided heating/ventilating/air-conditioning (HVAC) equipment. The ESS shall be adequate for full MASR performance with respect to the service conditions specified herein (3.6.1.1).

3.6.5.1 Shelter.- Shelter construction shall be in accordance with Specification FAA-E-2236a as modified to meet the size restriction of the MASR system. The FAA Radar Engineering Division Technical Officer shall determine acceptability of contractor-proposed modifications.

3.6.5.2 Engine generator.- The GFE 75KW diesel-powered automatic engine generator set per Specification FAA-E-2204a shall be integrated into the MASR system. The contractor shall enclose, protect, install and otherwise provide all additional material and services to satisfy the mobility concept of the MASR system. An "emergency start" function shall be remoted to the FAA Indicator Site of record at each MASR deployment. The engine generator, while operating, shall meet the service conditions specified herein (3.6.1.1). The engine generator shall meet the service conditions of FAA-E-2236a at all other times.

3.6.5.3 Heating, venting, and air-conditioning (HVAC).- The contractor shall provide HVAC for the electronics shelter required to satisfy paragraphs 3.4.1, 3.4.1.1, 3.4.2, 3.4.3, and 3.4.4 of Specification FAA-C-2507 and as specified herein (3.6.6).

3.6.6 Electronics shelter.- All ASR/SECRA electronics, test equipment, spares, cables, site interface kits, and other hardware required shall be housed within the electronics shelter. The shelter shall be securely mounted to a highway-type semitrailer. Size of the shelter shall be such that the total volume limitation of the shelter/trailer/EG combination of 8 feet by 13 feet, 6 inches, by 40 feet is not exceeded. The electronics shelter provided shall be an appropriately scaled version of the standard size identified by Specification FAA-C-2507.

3.6.6.1 Construction.- Shelter construction shall be in accordance with Specification FAA-C-2507 as modified to meet the size restriction of the MASR system. The FAA Radar Engineering Division Technical Officer shall determine acceptability of contractor-proposed modifications.

3.6.6.2 Temperature and humidity control.- Temperature and humidity control of the electronics shelter interior environment shall be in accordance with Specification FAA-E-2256a. Additional provisioning shall be made to preclude damage due to moisture during long periods of MASR system storage. ASR and SECRA subsystems within the electronics shelter shall not be exposed to service conditions exceeding those of Environment II, per Specification FAA-G-2100/1b, paragraph 1-3.2.23(f).

3.6.6.3 Acoustic noise level.- The contractor shall apply techniques of noise suppression and absorption to achieve a measured noise level of less than 65 dbA everywhere within the personnel working area of the electronics shelter interior. Floor carpeting and other novel methods of acoustic noise reduction are permitted to meet this requirement, subject to approval by the FAA Radar Engineering Division Technical Officer.

3.6.6.4 Junction box.- A radar cable junction box (RCJB) shall be installed within the electronics shelter. All signals among the ASR/SECRA, antenna, and EG subsystems and equipment requiring shelter external interface shall be distributed through the RCJB by means of connectors, terminal strips, etc. All video, trigger, power and control functions of cables passing through the RCJB shall be clearly marked. Ten percent spare connectors, terminal strips, etc., shall be provided and so marked.

3.6.6.5 External connections.- Connector panels shall be affixed to the exteriors of the electronics shelter, environmental support subsystem shelter and the antenna/tower subsystem to accommodate the following MASR interconnects:

- (a) Signal
 - (1) ASR video
 - (2) ASR triggers and pretriggers
 - (3) SECRA video
 - (4) SECRA triggers and pretriggers
 - (5) Azimuth position data (digital and analog)
 - (6) Remote control
 - (7) Intercom
 - (8) Waveguide
 - (9) SECRA antenna coaxes
 - (10) Spares

- (b) Control
 - (1) Antennas
 - (2) HVAC
 - (3) Spares
- (c) Primary Power
 - (1) Engine generator
 - (2) Commercial

Exterior connector panels shall be easily accessible from ground level, and shall be protected with weathertight covers during transport and when the MASR system is operational. All external electrical connectors shall be weathertight.

3.6.7 Trailers.- A maximum of two highway-type semitrailers shall be provided and modified as needed to satisfy the MASR packaging and mobility requirements specified herein. Trailers so provided shall meet all requirements of Specification MIL-M-8090F for Group D vehicles (semitrailers). The contractor shall provide formal documentation which shows compliance with paragraph 4.5, and subparagraphs thereto, of MIL-M-8090F.

3.7 Subsystem interconnects.- All interconnections required among MASR subsystems and not specifically furnished as GFE as specified herein, shall be provided by the contractor.

3.8 Site interface.- Hardware needed to interface the MASR system with all of the diverse FAA ASR Transmitter Sites shall be provided by the contractor. Such interface hardware shall be packaged as kits and economically stowed aboard the MASR. The contractor shall identify specific hardware items needed for this purpose.

3.9 Special installation tools.- The contractor shall supply all tools and equipment to be used in setting up the MASR system into its operational configuration. All such tools and equipment shall be economically stowed aboard the MASR.

3.10 Storage.- All equipment within the MASR shelters and enclosures shall be protected from damage due to moisture, airborne contaminants, and other deleterious conditions while the MASR system is in storage. Separate, automatically controlled electrical/electronic devices shall be provided for this purpose. Such devices shall be powered by an AC, 60 Hz, 120 v power source external to the MASR system.

3.11 Instruction book documentation.- The contractor shall provide instruction books for MASR system and subsystem operations which fully comply with Specification FAA-D-2494. The instruction books so provided shall consist of a single "system" volume containing all installation, operating, and maintenance instructions and data unique to the setup, operation, storage, and transport of the MASR system.

Instruction book data contained in the GFE instruction book which is valid for the MASR application shall not be duplicated. Replacement pages for the GFE instruction book required by hardware modification for MASR use shall be prepared in accordance with FAA Order 1320.38 and provided as a supplement to the MASR "system" volume herein specified. The GFE instruction books shall be added to, changed and portions deleted, in accordance with FAA-D-2494 only as affected by the provisions of this MASR specification and the terms of the contract.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality control program.- The contractor shall provide and maintain a quality control program which complies fully with FAA-STD-013a. In so doing, the contractor shall compile, integrate and document all tests and inspections required to substantiate MASR performance during design, development, manufacture, fabrication, operation, packaging, and shipping of the MASR system, subsystems and equipments. These tests and inspections shall be subjected to Government inspection, at the discretion of the Government, by the FAA Contracting Officer or his officially designated representative. The Government shall conduct any other inspections it considers necessary to assure compliance with this Specification, the contract, FAA-STD-013a and FAA-G-2100.

4.2 Tests.- The contractor shall prepare test procedures and data sheets, submit draft copies for approval 90 days prior to the proposed beginning of testing and conduct performance tests using the FAA-approved procedures according to the following:

<u>Test Nomenclature</u>	<u>FAA-G-2100/1b Paragraph Reference</u>	<u>FAA-E-2636 Data and Requirement</u>	<u>Test Request Notification</u>	<u>Test Verification</u>
Preliminary		3.6 and sub-paragraphs thereto. 4.2.1, 4.2.1.1	10 working days prior to test date prjctd.	FAA-witnessed at Contracting Officer option.
Design Qualification	1-4.2.3.1, 1-4.2.3.2(b), (d), (f), (g)	3.6 and sub-paragraphs thereto. 4.2.2	30 calendar days prior to test date projected.	FAA-witnessed.
Production	1-4.3.4	3.6 and sub-paragraphs thereto. 4.2.3	15 calendar days prior to test date projected.	FAA-witnessed.
System Operational Readiness Demonstration		3.6 and sub-paragraphs thereto. 4.2.4	15 calendar days prior to test date projected.	FAA-witnessed.

4.2.1 Preliminary.- The contractor shall demonstrate readiness for further testing by first completing this test. This preliminary test shall consist of verification of compliance with the following FAA-E-2636 performance parameters:

System -- paragraph 3.6.1

Service condition -- 3.6.1.1

Remote control -- 3.6.1.3

ASR-8 -- 3.6.1.3.1

SECRA -- 3.6.1.3.2

Engine generator -- 3.6.1.3.3

Grounding -- 3.6.1.4

Human engineering design -- 3.6.1.5

ASR subsystem -- paragraph 3.6.2

Operating frequency

MTI RX SCV

VSWR

Output signals

TX Peak power

Synchro output

TX P.W.

A/D converter output

RX N.F.

D/A converter output

NML RX MDS

Output trigger to SECRA -- Aligned (destaggered)

MTI RX MDS

Output trigger to SECRA (Staggered)

MTI LOG RX MDS

Radiation hazard-- 3.6.2.2

A/D converter -- 3.6.2.3.2

Azimuth position data -- 3.6.2.3

Selsyn equipment -- 3.6.2.3.3

D/A converter -- 3.6.2.3.1

Frequency agility -- 3.6.2.4

SECRA subsystem -- paragraph 3.6.3

TX Frequency

RX N.F.

RX Frequency

Output signals, defruiter "ON"

TX Power

Output signals, defruiter "OFF"

RX Sensitivity

Antenna/Tower subsystem -- paragraph 3.6.4

Tower assembly height -- 3.6.4.1

Tower assembly leveling -- 3.6.4.1

Tower assembly leveling effort -- 3.6.4.1

Tower assembly erection -- 3.6.4.1

Tower assembly stability -- 3.6.4.1

Tower assembly - ASR antenna installation -- 3.6.4.1

Tower assembly - SECRA antenna installation -- 3.6.4.1

ASR antenna assembly -- 3.6.4.2

SECRA antennas -- 3.6.4.3

Environmental Support Subsystem -- paragraph 3.6.5

Shelter -- 3.6.5.1

Engine generator -- 3.6.5.2

Heating, ventilating, and air-conditioning (HVAC) -- 3.6.5.3

Electronics Shelter -- paragraph 3.6.6

Construction -- 3.6.6.1

Temperature and humidity control -- 3.6.6.2

Acoustic noise level -- 3.6.6.3

Junction box -- 3.6.6.4

External connections -- 3.6.6.5

Trailer -- paragraph 3.6.7

Storage -- paragraph 3.10

4.2.1.1 Preliminary test data.- The contractor shall provide all preliminary test data to the FAA Contracting Officer at least 30 working days prior to the projected date for Government approval of final test procedures. All tests required by this specification shall be documented and in accordance with FAA-STD-013a.

4.2.2 Design qualification.- The contractor shall qualify the MASR design by formally demonstrating compliance with the following:

FAA-G-2100/1b. Rating verification, contractor-furnished material, paragraph 1-4.3.2.1. General tests per paragraph 1-4.3.2.2(b), (d), (f), (g).

FAA-E-2636. In accordance with paragraph 4.2.1.

Environmental Test. MASR remote control (paragraph 3.6.1.3, 3.6.1.3.1, 3.6.1.3.2, 3.6.1.3.3, 3.6.5.2) and antenna/tower, electrical/hydraulic erection, leveling and installation devices (3.6.4, 3.6.4.1, 3.6.4.2, 3.6.4.3) specified herein shall satisfactory complete testing under MASR service conditions (paragraph 3.6.1.1) and test procedure specified by FAA-G-2100/1b, paragraph 1-4.12.

4.2.3 Production.- The contractor shall complete the following sequence:

- (a) The contractor, at his plant shall test the completed MASR to demonstrate compliance with MASR system performance parameters (3.6 and subparagraphs thereto). All parameters are to be measured in accordance with TI test procedure 878992 and values recorded. The MASR engine generator (3.6.5) shall supply all MASR power during tests.
- (b) The contractor shall continue operation of the MASR system, configured as described in paragraph 1.1(b), for 24 consecutive hours in accordance with TI test procedure 870497. During this time, the MASR system shall be operated at full capability and shall have no relevant failures. At the conclusion of the above 24 hour period, the contractor shall again demonstrate and record compliance with MASR system parameters (3.6 and subparagraphs thereto), and TI test procedure 878992.

4.2.4 System operational readiness demonstration.- Final acceptance of the MASR system by the Government shall be contingent upon the contractor's successful demonstration of MASR system performance according to the following procedure:

- (a) Four (or less) contractor-employed electronics technicians shall "break-down" the MASR and rig for over-the-road transport. The time required for this task shall be recorded. No further contractor access to the MASR is authorized until MASR arrival at a contract-specified location.
- (b) The FAA Contracting Officer shall formally notify the contractor to arrange transport of the MASR system to the contract-specified location (this will be within 1500 miles of the contractor's plant). Transport shall be over-the-road by leased commercial tractor and operated at road speeds equivalent to those of commercial vehicles of the same GVW and overall dimensions.
- (c) Four (or less) contractor-employed electronics technicians shall, upon delivery of the MASR at the contract-specified site, set up the MASR system to full operation within eight consecutive hours. The set up time shall be recorded. MASR performance parameters shall be measured and meet or exceed values of paragraph 3.6 and subparagraphs thereto, tested in accordance with TI test procedure 889053.
- (d) The MASR shall operate at full capability for 48 consecutive hours with no relevant failures. An FAA commissioning flight inspection (per FAA Order OA P 8200.1, Section 215) shall be satisfactorily completed during this interval. Remote control of EG on line/commercial power operation shall be demonstrated by exercising the EG automatic power transfer equipment (FAA-E-2204a, paragraph 3.4.12) through activation of the MASR "Emergency Start" function herein specified (3.6.1.3.3).
- (e) At the conclusion of the 48 hour test, the contractor shall break-down the MASR and rig for over-the-road transport to the final delivery location specified in the contract schedule.

5. PREPARATION FOR DELIVERY

5.1 Packaging.- The MASR system shall be packaged in the nominal over-the-road configuration for final delivery.

5.2 Preservation.- The MASR system shelters shall be protected from formation of internal condensation while awaiting delivery and at all times while in a non-operational condition.

5.3 Destination.- Per contract schedule.

6. NOTES

6.1 Note on information items.- The contents of this section are only for the information of the procurement request initiator and are not a part of the requirements of this specification. They are not contract requirements nor binding on either the Government or the contractor. In order for these terms to become a part of a resulting contract, they must be specifically incorporated into the schedule of the contract. Any reliance placed by the contractor on the information in these subparagraphs is wholly at the contractor's own risk.

6.2 Instruction books.- A total GPO printing quantity of 250 MASR system instruction books is planned.

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